

**OBSERVATIONS ON THE "GUEST ANT" *FORMICOXENUS NITIDULUS* (NYLANDER) IN NESTS OF THE RED WOOD ANT *FORMICA RUF*A L. IN 1997**

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*Formicoxenus nitidulus* is a small, shining myrmecine ant which lives as an inquiline within the large mound nests of the wood-ant *Formica rufa* and related species (e.g. *F. lugubris* Zett. and *F. aquilonia* Yarrow). It nests in small colonies in hollow twigs within the host's nest and thus is difficult to detect except on occasions when workers, males or winged females emerge onto the surface of the mound (Bolton and Collingwood, 1975). Males, which are about 3 mm long and have a shining black abdomen and reddish head and thorax (occasionally pale yellow), are wingless and closely resemble workers but have 12 segments in their antennae whereas workers and queens have 11. *Formicoxenus* mixes freely with the host workers, apparently obtaining food from them when they are regurgitating and escaping with agility if attacked (Brian, 1977). It occurs locally in most of the wood ant areas of England and Scotland, but as it is seldom seen it is not known what proportion of wood ant nests contain it. It has rarely been recorded in Wales or North-west England, and was not known in Lancashire prior to 1996 (Garland and Appleton, 1994). There are differences of opinion as to whether it is actually a parasite (Skinner and Allen, 1996) but Holldobler and Wilson (1990) consider it to be an example of xenobiosis: "the relationship in which colonies of one species live in the nests of another species and move freely among the hosts, obtaining food from them by regurgitation or other means but still keeping their brood separate".

**GAIT BARROWS NNR**

On the morning of 10 September 1997 I visited Gait Barrows National Nature Reserve, Lancashire (SD483775) to record the condition of nine nests of *F. rufa* which I have been keeping under observation as part of a more general study on the status of this species in NW England, but where I had never seen *Formicoxenus*. I had previously found it in one nest on Arnside Knott, Cumbria (SD455775), 3 km to the west, on 21 October 1996, and it also had been found at Eaves Wood (SD465763) 2 km to SW on 9 July 1996 by the National Trust Biological Survey Team (A. P. Foster, pers. comm.), which was the first record for Lancashire. I found numerous individuals, which I subsequently identified as males, running about on the surface of the first nest I looked at. They were most easily seen on the lower, more humified, part of the nest below the thatched mound on which the *F. rufa* workers were more densely active. Most of the time they appeared to run about with impunity, but if one ran directly in front of a host worker the latter would react and pounce on it, though the *Formicoxenus* always escaped. They appeared to be released immediately—I never saw one disabled in any of these encounters. I then examined all the nests in the woodland which I normally visit and found *Formicoxenus* on the seven which were active (two small nests had been abandoned during the course of the summer). Its presence was not always obvious—it had been my intention to spend up to 5 minutes looking at

each nest, but it was usually seen within 2 minutes and never took longer than 4 minutes. Specimens from the first nest were confirmed as males; I did not see any workers or females.

Wood ants are abundant in the wooded limestone parts of the Reserve, in spite of much of the limestone pavement and woodland (ash, hazel, oak, birch, yew) having been damaged by rockery stone removal before it became an NNR in 1975. The ants evidently survived this upheaval. Indeed it may have benefited their habitat by creating patchy woodland with numerous bare rock suntraps, and many of the nests are now situated in areas which were stripped of their surface layers of stone in the early 1970s. These areas have been slowly but progressively invaded by regeneration from the surrounding woodland. Management of the Reserve includes regular coppicing to maintain more open conditions primarily for the benefit of nationally important populations of butterflies such as Duke of Burgundy and pearl-bordered and high brown fritillaries. Thus the wood ant nests are liable to be subject to the effects of gradual closure of the canopy and sudden reopening. Although *F. rufa* can persist successfully under closed canopy in the Midlands (C. A. Collingwood, pers. comm.), my observations in north Lancashire and south Cumbria, where it is at the northern limit of its range in Britain, suggest that complete shading results ultimately in the demise of nests.

#### RANGE OF NESTS WITH *FORMICOXENUS*

The *F. rufa* nests at Gait Barrows had been selected to observe the effects of scrub invasion and coppicing, and they demonstrate the full range of conditions which might affect colonies. Three were typical vigorous nests in sheltered but sunny situations on south-facing ride edges, though one of these was beginning to be shaded on the south side. One, found to have a small patch of revitalized (or recolonized?) activity, was a very large old mound of mainly humified material which showed no sign of life in spring 1997 and was thought to have been shaded out before the compartment was coppiced two years previously. A mound of similar size, likewise exposed by coppicing, which was highly active in the spring, had been overshadowed by vigorous growth of rose, bramble and bracken due to increased admission of light. Although there were trails leading from it, the mound had only a few sluggish workers and little new thatch. Another long-established nest, which had become progressively more shaded in recent years, was nearly defunct, but was connected by trails to a vigorous new nest in a sunny situation. Interestingly, *Formicoxenus* was present on both the old and new nests. Holldobler and Wilson (*op. cit.*) consider the ability to emigrate in columns of the host workers, when the latter change nest sites, to be an adaptation to the commensal life.

To see whether this synchronized emergence of *Formicoxenus* was peculiar to the NNR or was occurring elsewhere, I went in the afternoon to Arnside Knott, which is owned by the National Trust. It has numerous *F. rufa* nests and, as at Gait Barrows, scrubby areas are being opened up for butterflies. Here the situation was less clear-cut. I was unable to find *Formicoxenus* at the nest where I first saw it in 1996, but I did find it on 2 other nests. On later visits in September and October I found males on 10 further nests, including the one where I had first seen them in 1996, and on one occasion at one nest I found 2 dealate queens. These are larger than the males and are uniformly dark in colour. However there are several nests where I have not yet seen *Formicoxenus* on any visit.

EXTENT OF *FORMICOXENUS* IN THE HOST POPULATION

The fact that *Formicoxenus* was found in such a wide variety of nests at Gait Barrows, and on every nest which I had looked at in September, suggested that it might be present in all the *F. rufa* nests. It would have been impractical to examine all the nests as there are known to be over 100 on the NNR. Their locations had been mapped in detail by Tony Aldridge, Warden 1980–1992 (Aldridge, 1991) and the most recent survey (Farinacci and Smith, 1996) raised the total to 112. To examine a sample, I set out to see if I could find *Formicoxenus* in every part of the Reserve where wood ants occurred. Unsettled weather delayed observations, but during a spell of anticyclonic sunny weather in October, I was able to establish that *Formicoxenus* was present in all nine management compartments of the Reserve which contained *F. rufa* nests. I found queens (dealate) on only one nest. By this time many nests were shaded and inactive due to the lower angle of the sun. I found *Formicoxenus* only on nests which were still receiving insolation and were active, but the fact that I found it in every compartment which contains nests suggest that it is present throughout the *Formica rufa* population on the NNR.

Mating between the wingless males and winged females is reported to take place on the mound; afterwards some females fly away to look for new nests while others return into the original one (Brian, *op. cit.*). The fact that the two queens found on one nest on Gait Barrows on 29 September, and those found on one nest on Arnside Knott on 21 October, had shed their wings suggests that mating had taken place. I never saw any winged females, and found only males, including some small pale specimens which I had thought might have been workers. The number seen at any one time ranged from one or two to about a dozen. They might be glimpsed anywhere on the mound, but were most frequently seen around the holes where host workers were emerging. When numerous they often came running out 3 or 4 together, which would equate with them originating from their individual small nests, of which there may be many in a single *F. rufa* mound (C. A. Collingwood, pers. comm.). At two sites they were seen running out onto bleached branches and rocks which were projecting from the mound, on one occasion being observed 0.5 m away from the nest on a slab of white limestone. They run rapidly and incessantly, unlike the *F. rufa* workers which proceed in a more jerky fashion, and were sometimes seen to disappear back inside the nest. The response of the host workers depended on their state of activity. When very active and aggressive they would attack, as described above, though apparently without causing injury. At lower temperatures, when they were less active and aggressive, the *Formicoxenus* could run past them, or even under them, without provoking any reaction. The response of the guest to being attacked has been described as to remain motionless, although in rare cases they have been observed to sting the host (Skinner and Allen, *op. cit.*). The latter observation must have been of workers, as males do not possess stings. Occasionally two *Formicoxenus* were seen to grapple with each other. This was on the surprisingly late date of 27 October, on a nest where I saw more males than on any other occasion and they were running out onto a bleached branch where I was able to photograph them. This was the last date on which the males were really active, but on 21 November I visited the same nest and found some very lethargic *F. rufa* workers emerging from two entrances close to a sun-warmed rock. Within these holes I saw some equally lethargic *Formicoxenus* males which were easy to extract for further photographs. However by 1 December the top of the nest had been much disturbed and drilled, probably by a green woodpecker, and there was no sign of either species, which no doubt were wintering in the lower levels of the nest.

## AN EXCEPTIONAL SEASON?

I hope that further observations will establish whether this scale of synchronized emergence is an annual occurrence, or whether 1997 was an exceptional year for *Formicoxenus* males. Cedric Collingwood has informed me that during August he looked at numerous nests of *Myrmica rubra* (L.) in the Yorkshire Dales, searching for females of the form *M. microrubra* Seifert, but only found winged males, no females, and that Alfred Buschinger reported the same phenomenon around Darmstadt in Germany at the same time. This raises the possibility that conditions were in some way unusual in 1997, causing ant colonies to produce abundant males, but few females.

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## WANTED

**Information on the crepuscular activities and location of dung-associated species in the winter months.**

I am involved in research into the diet of the lesser horseshoe bat in the winter months in Cornwall. From faecal analysis it has been found that Sphaeroceridae, Scathophagidae and Mycetophilidae are important, also Tipulidae and Trichoceridae.

Any information please to: Adrian Spalding, Tremayne Farm Cottage, Praze-an-Beeble, Camborne, Cornwall TR14 9PH or email A.Spalding@btinternet.com